



# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference BP110108/VMY	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/FI2004/000523	International filing date ( <i>day/month/year</i> ) 10.09.2004	Priority date ( <i>day/month/year</i> ) 11.09.2003	
International Patent Classification (IPC) or national classification and IPC C08B31/04, C08J3/09			
Applicant KEMIRA OYJ et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> <i>sent to the applicant and to the International Bureau</i> a total of sheets, as follows:</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> <i>(sent to the International Bureau only)</i> a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  06.07.2005		Date of completion of this report  14.11.2005	
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  Mazet, J-F  Telephone No. +31 70 340-3509  	

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

10/566975  
IAP9 Rec'd PCT/PTO 02 FEB 2006  
International application No.  
PCT/FI2004/000523

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3 and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4)
    - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements**\* of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-16 as originally filed

**Claims, Numbers**

12 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
    - ☐ the description, pages
    - ☐ the claims, Nos.
    - ☐ the drawings, sheets/figs
    - ☐ the sequence listing (*specify*):
    - ☐ any table(s) related to sequence listing (*specify*):
  4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
    - ☐ the description, pages
    - ☐ the claims, Nos.
    - ☐ the drawings, sheets/figs
    - ☐ the sequence listing (*specify*):
    - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	1-12
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V.**

The following documents are referred to in this communication:

- D1: DATABASE CHEMABS CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; "Preparation of N-alkoxyalkylimidazolium salts and ionic liquid or gel containing them." XP002313845 retrieved from STN Database accession no. 136:85811
- D2: GB-A-1 425 624 (BACKHAUS ARTHUR A) 15 August 1922 (1922-08-15)
- D3: KIMIZUKA N ET AL: "Spontaneous Self-Assembly of Glycolipid Bilayer Membranes in Sugar-philic Ionic Liquids and Formation of Ionogels" LANGMUIR, ACS, WASHINGTON, DC, US, vol. 17, 2001, pages 6759-6761, XP002219946 ISSN: 0743-7463

**The present application appears to meet the criteria of Article 33(1) PCT.**

**1. Novelty**

Document D1 discloses (see abstract) the use of imidazolium salts (ionic liquid at room temperature) as solvent and reaction medium for polysaccharides (cyclodextrin, agarose) in chemical modification processes using water-unstable modifying agents such as acid halides or acid anhydrides from which the subject-matter of claim 1 differs in that the method is applied to starch.

Document D2 discloses a method for esterifying starches in dry conditions by subjecting a mixture of starch and esterifying agent to microwave energy (page 1, lines 36 - 53 and page 2, lines 57 - 75) from which the subject-matter of claim 1 differs in that ionic liquids is used as solvent for starch and as reaction medium.

**The subject-matter of claim 1 appears therefore to be novel (Article 33(2) PCT).**

**2. Inventive step**

The document D2 is regarded as being the closest prior art to the subject-matter of claim 1 and discloses (the references in parentheses applying to this document): a method for esterifying starches in dry conditions (moisture content preferably below 2 % by weight) by subjecting a mixture of starch and carboxylic acids or carboxylic acid anhydrides to

microwave energy.

The subject-matter of claim 1 therefore differs from this known D2 in that the process is not conducted in solid phase but in homogeneous phase using ionic liquid solvent for starch.

The problem to be solved by the present invention may therefore be regarded as to provide a homogeneous reaction medium for converting starch into ester derivatives (in the absence of water) in high yields and in any degrees of substitution.

The proposed solution is the use of ionic liquids as a solvent and reaction medium for the esterification of starch.

The use of ionic liquids has already been proposed for the dissolution and modifications of certain polysaccharides in document D1, which discloses the use of certain kinds of imidazolium salts (N-alkoxyalkylimidazonium salts) as solvent and reaction medium for polysaccharides (namely agarose and cyclodextrin) in chemical modification processes using water-unstable modifying agents such as acid halides or acid anhydrides.

Cyclodextrin is a cyclic oligosaccharide of glucose linked with (1,4)-alpha linkages, whose structure is quite different from the structure of starch. Starch is a giant molecule composed of amylopectin (bushlike structure containing both (1,4)-alpha-linkages and (1,6)-alpha branch points) and amylose (linear (1,4)-alpha-glucan). Agarose is a linear polymer, quite different from starch.

Document D3 discloses that amylose can be easily dissolved in N,N-dialkylimidazolium salts having an ether linkage in one of the alkyl chains (page 6760, column left), and suggest that this could be a way for further chemical modifications (page 6761, column right). Document D4 teaches that amylose (which is coiled and only slightly soluble in pure water) is not soluble in 1-methyl-4-butylimidazolium PF6 salt (page 6759, chart 1 and page 6760, column left). This is rather a point to dissuade the skilled person from using BMIM salts for dissolving starch.

The prior art (as represented by D1, D2 or D3) does not give any indication or suggestion which could lead the skilled person facing the same above mentioned problem to contemplate ionic liquids as a convenient medium for use in a three-step method for preparing organic starch esters by dissolving the starch, treating with an organic esterifying agent and separating the starch ester from solution.

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

**PCT/FI2004/000523**

**The subject-matter of claim 1 appears to involve an inventive step in the sense of Article 33(3) PCT.**

**Claims 2-12 are dependent on claim 1 and as such also appear to meet the requirements of the PCT with respect to novelty and inventive step.**